International Symposium on *Salmonella* and Salmonellosis, 20–21 May 1997, Ploufragan, France

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Human salmonella infection, in Europe and North America, has evolved dramatically during this century. From a predominance of the *Salmonella typhi* serotype, it has moved to serotypes that are commonly found in animals and transmitted to humans by foods. While the fall in *S. typhi* infection followed improvements in hygiene and sanitation, several international epidemics of salmonella infection, among which is the *S. enteritidis* epidemic that affected Europe and North America, have occurred during the last two decades. These outbreaks in humans followed the wide contamination of animals in intensive livestock farms (poultry, cattle, pigs). In short, salmonella infection has moved from being a human infection to being the most common zoonosis in Europe and North America, despite improvements in food hygiene. In this context, the free trade of foods in Europe, North America and other parts of the world has increased the opportunity for the diffusion from one place to another of foods contaminated with a particular *Salmonella* serotype. Although major efforts have been already made by the food industry and the national veterinary and food hygiene institutions, the incidence of *Salmonella* in humans and in animals has not been reduced and is even increasing. Therefore, the control and prevention of this zoonosis cannot be achieved at a national level only. An international approach for research, surveillance, control and prevention is needed, although the strategy may vary by country, according to the local epidemiology. In addition, particularly after the bovine spongiform encephalopathy epidemic in the UK, the public demand for improved food quality has fostered the need for a more comprehensive approach.

Based on these grounds, an international symposium on *Salmonella* and salmonellosis was organized in 1992 by the French Centre National d'Etudes Vétérinaires et Alimentaires and the Institut National de la Recherche Agronomique, in Ploufragan (Bretagne, France) that focused mainly on salmonellosis in poultry because of the recent *S. enteritidis* epidemic in Northern Europe and North America. Five years later, as the S. *enteritidis* problem in eggshells had not been solved and new problems had emerged, the same institutions in association with the French Réseau National de Santé Publique organized a new international symposium on 20–21 May at the same location as in 1992. The 1997 venue was aimed to set up an open forum for new ideas and concepts to be discussed simultaneously by scientists, engineers, technicians and public-health practitioners facing daily problems associated with *Salmonella* and salmonellosis, so as to review all the available facts and data, determine the state of the art and generate new lines of thought and action in the field of animal and food hygiene and public health [1].

According to the aims stated below, the program of the symposium explored all the aspects of this very common bacterium, which gave the participants the unique opportunity to catch up on all new developments, during the last 5 years, in all possible fields of salmonellosis: microbiology, epidemiology, pathogenicity, control and prevention. The symposium was, therefore, organized in seven sessions, each introduced by a review: (1) detection–identification-typing; (2) mechanism of pathogenicity; (3) persistence and carriage host sensibility; (4) epidemiology—food-producing animals, environment and food industry; (5) hygienic and prophylactic systems; (6) epidemiology of human salmonellosis; and (7) national and international surveillance systems. Four hundred participants—microbiologists, veterinarians, sanitary engeneers, food hygiene specialists, researchers, public-health practitioners—from 30 countries were exposed during the 3 days of the scientific program to new international developments not only in their field of expertise, but also in others.

The first session, on detection–identification–typing, reviewed the new molecular techniques that had rapidly emerged over the previous 5 years (PCR, ribosomal RNA sequence comparison, phylogenetic relations, restriction patterns of phage DNAs, molecular methods for the epidemiologic analysis of serovars of zoonotic importance) and also stressed the continuing interest in using more conventional detection and typing techniques (agar gel enzyme assay, rapid cultural methods). Presentations and posters dealt not only with methodological aspects but also with methods of comparison and evaluation and, more interestingly, with their practical application in the field (detection of *Salmonella* in surface water, shellfish and poultry, comparison of isolates). The synthesis of this very rich session is not easy to formulate. However, it may be summarized as follows: the key is not to identify the unique technique that will resolve all the problems (this technique does not exist) but to combine appropriately several methods to enhance the discrimination among genotypically homogeneous serovars of *Salmonella*.

The second section sought all new findings and ideas on pathogenicity in animals and, most importantly, mechanisms that may alter it. The presentation dealt with many aspects, such as the influence of environmental pH, the genetic determinants of intestinal invasion and disruption, the role of the virulence plasmid in the lysis of macrophages, the virulence and vaccine potential of *S. typhimurium* mutants, methods of rapid evaluation of the pathogenicity of strains isolated from poultry, the role of fimbriae in virulence, sop proteins, and cytokine gene expression.

Persistence and carriage host susceptibility, a very important topic for control and prevention, is still poorly understood. In the session devoted to this theme, determinants that may contribute to persistence and carriage were discussed: gut flora, adhesion and invasion, host genetic background, genetic control of resistance to *Salmonella* infection, the influence of humoral immune response, vertical transmission, environmental factors, and horizontal transmission.

The current epidemiology of *Salmonella* infection was discussed in two sessions, one devoted to food-producing animals, the environment and the food industry, and the other to the epidemiology of human infection. For food-producing animals, the current situation is very worrying and can be summarized as follows: although primarily intestinal bacteria, *Salmonellae* are widespread in the environment and commonly found in farm effluents, human sewage and in material subject to fecal contamination; salmonellosis has been recognized to be most prevalent in areas of intensive animal husbandry, especially poultry and pigs. In this context, the challenge for disease control is very important. Among animals, most infections originate from other animals, usually of the same species, but the roles of the animal environment at the farm and contamination from animal feeds are also important, which stresses the importance of good hygiene and food legislation. Human sewage is also an important potential source of contamination of the environment and animals. These points were illustrated by many presentations (prevalence in slaughter houses, roles of serology and culture programs for cattle, contamination of beef carcasses, antibiotic susceptibility of *S. typhimurium* strains of bovine origin, prevalence of infection, risk factors for *Salmonella* infection in broiler flocks, *Salmonella* in domestic reptiles and turtles, *Salmonella* in bivalve molluscs, enrofloxacin sensitivity monitoring of avian *Salmonella* in Europe). Human epidemiology in 1997 is characterized by a continuing very high incidence in humans. *Salmonella enteritidis* is not yet on the decrease (it is still increasing in Europe) and *S. typhimurium* has been increasing in most countries during the last 2 years. New epidemiologic expression of salmonella infection was stressed, particularly community-wide outbreaks. These outbreaks, although the inoculum and the attack rate are relatively low, can be very large because the implicated foods are very widely distributed, often in several countries. Classical (raw milk, cheese) and also new and unusual food vehicles were reported (alfalfa sprouts have been involved in several international outbreaks during the last 2 years). The emergence of this vegetable as a vehicle of salmonellosis indicates that foods not of animal origin may also play a major role in the international diffusion of this infection, probably after contamination of the alfalfa seeds during the industrial preparation process. After its occurrence in cattle, multidrug resistance of *S. typhimurium* DT104 has also been recognized, in all European countries, as the most recent new concern for the human side of this zoonosis.

In the session on hygienic and prophylactic systems, a full range of techniques applied to different animal species (chicken, cattle, pigs) were analyzed by various contributions from different countries: vaccines, yeast to reduce colonization, gut flora, disinfectants, environmental decontamination, and antibiotic treatments. At this stage, no single method is expected to solve the salmonella problem and emphasis should be placed on good hygiene and hazard analysis and control of critical point procedures. The last session was devoted to national and international surveillance systems (in animals, foods and humans) which are critical to monitor the impact of control measures and detect as soon as possible the emergence of new problems.

This international symposium showed that the salmonella zoonosis, a global problem, is very far from being controlled and that tremendous efforts will be needed to improve the current situation. As the food industry, food habits and the susceptibility of some populations (elderly, immunocompromised) are changing, we are faced with an unresolved problem and new hazards, among which is the development and the international spread of multidrug resistance in animals and humans. A global approach, which should implicate all disciplines of human and veterinary medicine and public health, is, more than ever, needed to deal with this old but still very dynamic infection.

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Reference

1. *Salmonella* and salmonellosis proceeding, Editors: Colin P, Legoux M, Clement G. Ploufragan, France, 20–21 May 1997, 674 pages. The proceedings of the symposium can be obtained from: ISPAIA-ZOOPOLE, Boite Postale 7-22440 Poufragan, France.